

WHAT IS CLAIMED IS:

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1. A microwave plasma processing apparatus comprising:

a wavelength reducing member reducing a wavelength of a microwave transmitted therethrough;

10 a slot electrode guiding the microwave exiting the wavelength reducing member, the slot electrode provided adjacent to the wavelength reducing member;

a first temperature control device controlling a temperature of at least one of the slot electrode and

15 component parts including the wavelength reducing member provided in the vicinity of the slot electrode; and

a process chamber into which the microwave exiting the slot electrode is introduced so that plasma is generated by the microwave within the process chamber.

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25 2. The microwave plasma processing apparatus as claimed in claim 1, wherein the first temperature control device controls the temperature of the slot electrode to be in a predetermined temperature range so as to promote a water component being released from other components in the process chamber.

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3. The microwave plasma processing apparatus as claimed in claim 2, wherein the predetermined temperature range is $70 \pm 10^\circ\text{C}$.

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4. The microwave plasma processing apparatus as claimed in claim 1, wherein the first temperature control device controls the temperature of the wavelength reducing member so as to control the temperature of the slot electrode by utilizing transmission of heat between the wavelength reducing member and the slot electrode.

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5. The microwave plasma processing apparatus as claimed in claim 1, further comprising an antenna accommodating member accommodating the wavelength reducing member, wherein the first temperature control device controls a temperature of the antenna accommodating member so as to control the temperature of each of the wavelength reducing member and the slot electrode by utilizing transmission of heat between the antenna accommodating member and each of the wavelength reducing member and the slot electrode.

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6. The microwave plasma processing apparatus as claimed in claim 1, further comprising a dielectric

material member interposed between the slot electrode and the process chamber, wherein the first temperature control device controls the temperature of one of the wavelength reducing member and the dielectric material member so as 5 to control the temperature of the slot electrode by utilizing transmission of heat between the slot electrode and the one of the wavelength reducing member and the dielectric material member.

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7. The microwave plasma processing apparatus as claimed in claim 1, further comprising a second 15 temperature control device controlling a temperature of an object to be processed within the process chamber.

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8. The microwave plasma processing apparatus as claimed in claim 6, further comprising a third temperature control device controlling a temperature of a periphery of the dielectric material member.

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9. The microwave plasma processing apparatus as 30 claimed in claim 1, wherein the first temperature control device includes a temperature control arrangement for controlling a temperature of a side wall of the process chamber.

10. A plasma processing method comprising the steps of:

placing an object to be processed in a process chamber;

5 controlling a pressure inside the process chamber;

controlling a temperature of a slot electrode radiating a microwave toward the process chamber by utilizing transmission of heat between the slot electrode

10 and other component parts surrounding the slot electrode;

introducing a reaction gas into the process chamber;

15 supplying a microwave to the slot electrode; and processing the object by plasma generated by the reaction gas and the microwave introduced into the process chamber.

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11. The plasma processing process as claimed in claim 10, wherein the step of controlling a temperature includes the step of:

controlling a temperature of a wavelength 25 reducing member so as to control the temperature of the slot electrode by utilizing transmission of heat between the wavelength reducing member and the slot electrode, the wavelength reducing member reducing a wavelength of the microwave supplied to the slot electrode;

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12. The plasma processing process as claimed in claim 10, wherein the step of controlling a temperature includes the step of:

controlling a temperature of a dielectric
5 material member provided between the slot electrode and the process chamber so as to control the temperature of the slot electrode by utilizing transmission of heat between the dielectric material member and the slot electrode.

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13. The plasma processing process as claimed in
15 claim 10, further including the step of controlling a temperature of an object to be processed within the process chamber.

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14. A plasma processing method comprising:
placing an object to be processed in a process
chamber;
25 controlling a pressure inside the process
chamber;
controlling a temperature of a slot electrode
radiating a microwave toward the process chamber;
introducing a reaction gas into the process
30 chamber;
supplying a microwave to the slot electrode when
a temperature of the slot electrode is below a
predetermined temperature; and

processing the object by plasma generated by the reaction gas and the microwave introduced into the process chamber.

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15. The plasma processing process as claimed in claim 14, wherein the step of controlling a temperature 10 includes the step of:

controlling a temperature of a wavelength reducing member so as to control the temperature of the slot electrode by utilizing transmission of heat between the wavelength reducing member and the slot electrode, the 15 wavelength reducing member reducing a wavelength of the microwave supplied to the slot electrode;

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16. The plasma processing process as claimed in claim 14, wherein the step of controlling a temperature includes the step of:

controlling a temperature of a dielectric 25 material member provided between the slot electrode and the process chamber so as to control the temperature of the slot electrode by utilizing transmission of heat between the dielectric material member and the slot electrode.

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17. The plasma processing process as claimed in
claim 14, further including the step of controlling a
temperature of an object to be processed within the
process chamber.

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